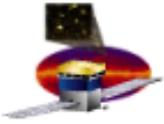


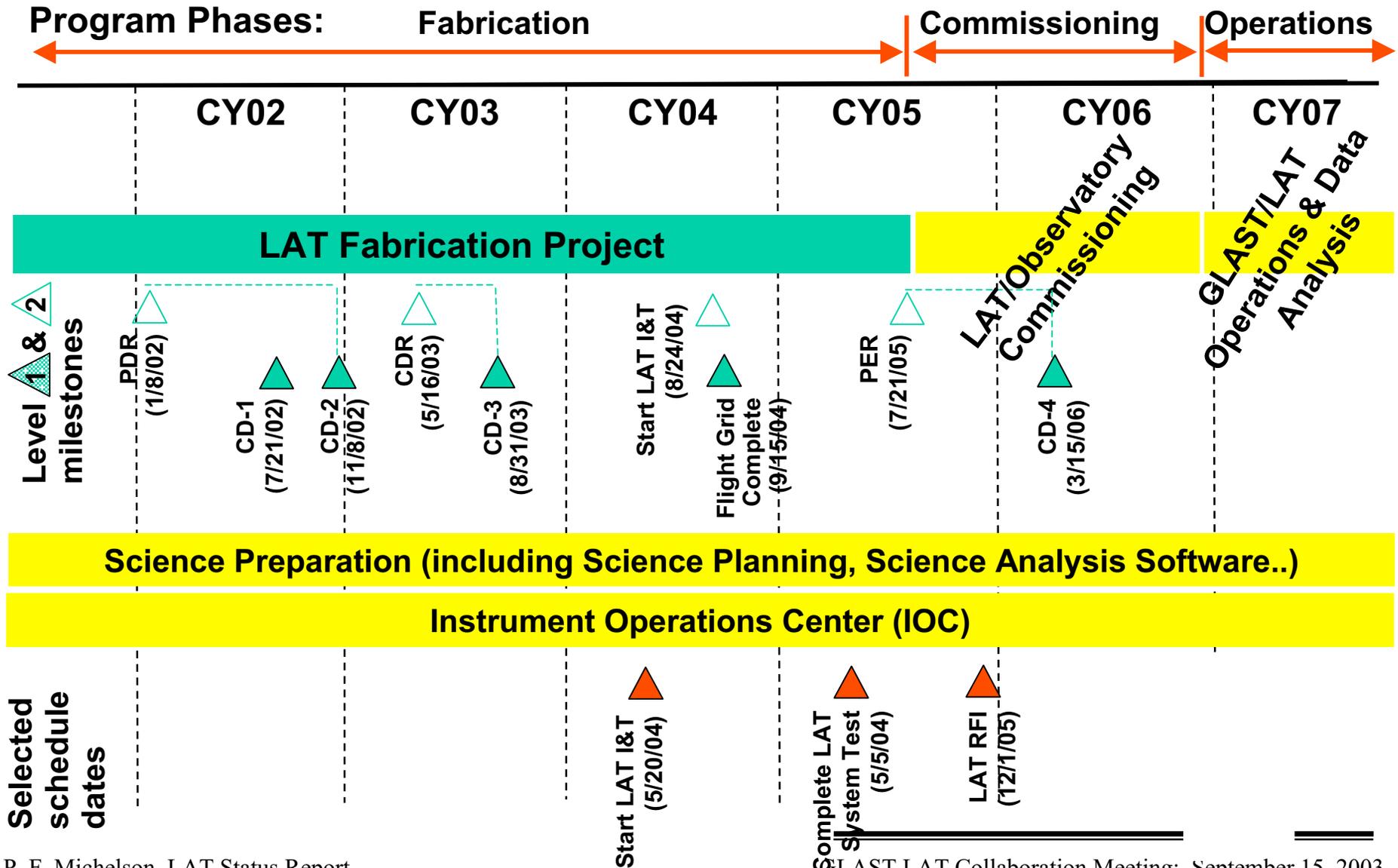
Status of Operations Phase Planning

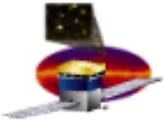
P. F. Michelson
Stanford University

GLAST LAT Collaboration Meeting
Rome, Italy
September 15, 2003



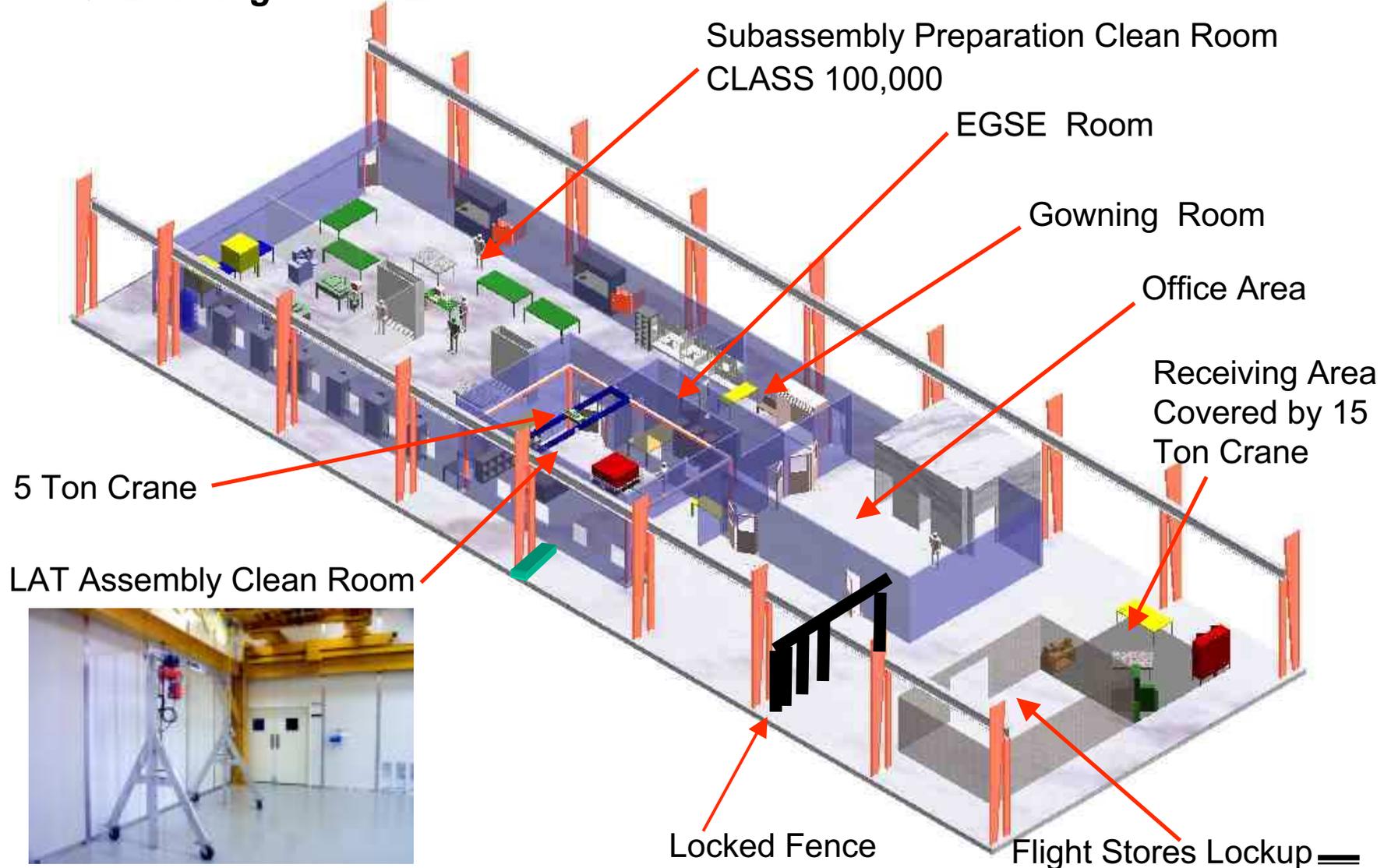
Elements of GLAST LAT Program

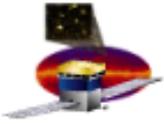




LAT Integration & Test Facility

► Building 33 at SLAC

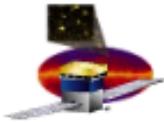




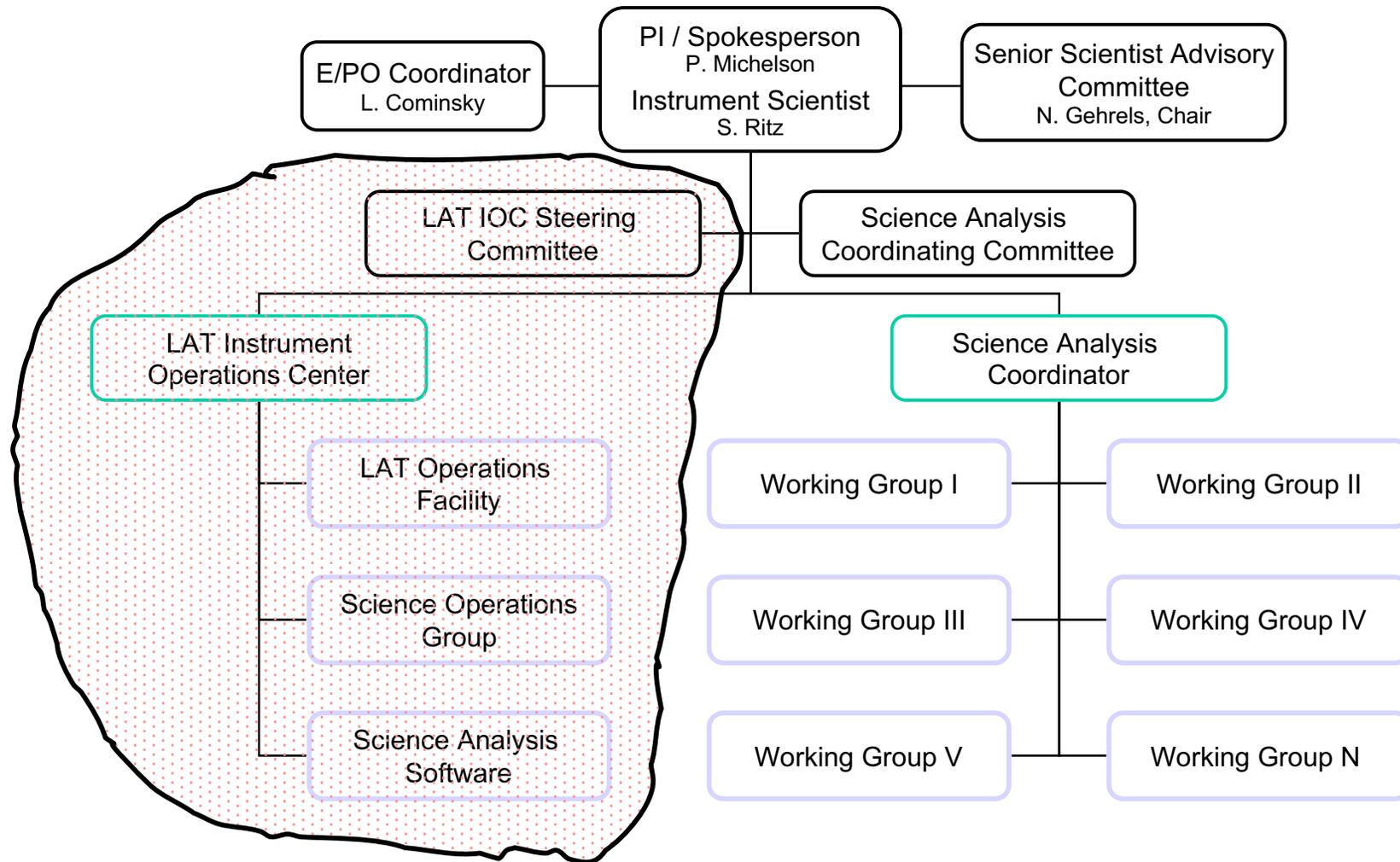
Ad Hoc Working Group on Instrument Operations Center (IOC) Planning

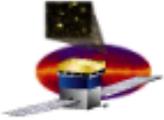
- Membership: S. Digel (chair), E. do Couto e Silva, R. Dubois, P. Nolan, H. Tajima (with participation from S. Ritz, instrument scientist)
- Charge to Working
 - examine the plans to date for the IOC and, in particular, assess the adequacy of the IOC plan for serving the science needs of the collaboration.
 - develop an operational picture/description that illustrates the role of each IOC element and the relationships between the elements.
 - develop a strawman staffing plan that identifies needed full-time (and part-time) scientists, engineers, technicians, etc. Consideration should be given to how I&T activities will eventually phase out and the IOC will become fully operational.
 - examine examples from other space astrophysics missions (e.g. CGRO/EGRET, SWIFT, Chandra, RXTE, SOHO/MDI., etc.) to understand the “lessons learned” and apply them in the context of GLAST

Group has produced a draft “white paper” on the IOC

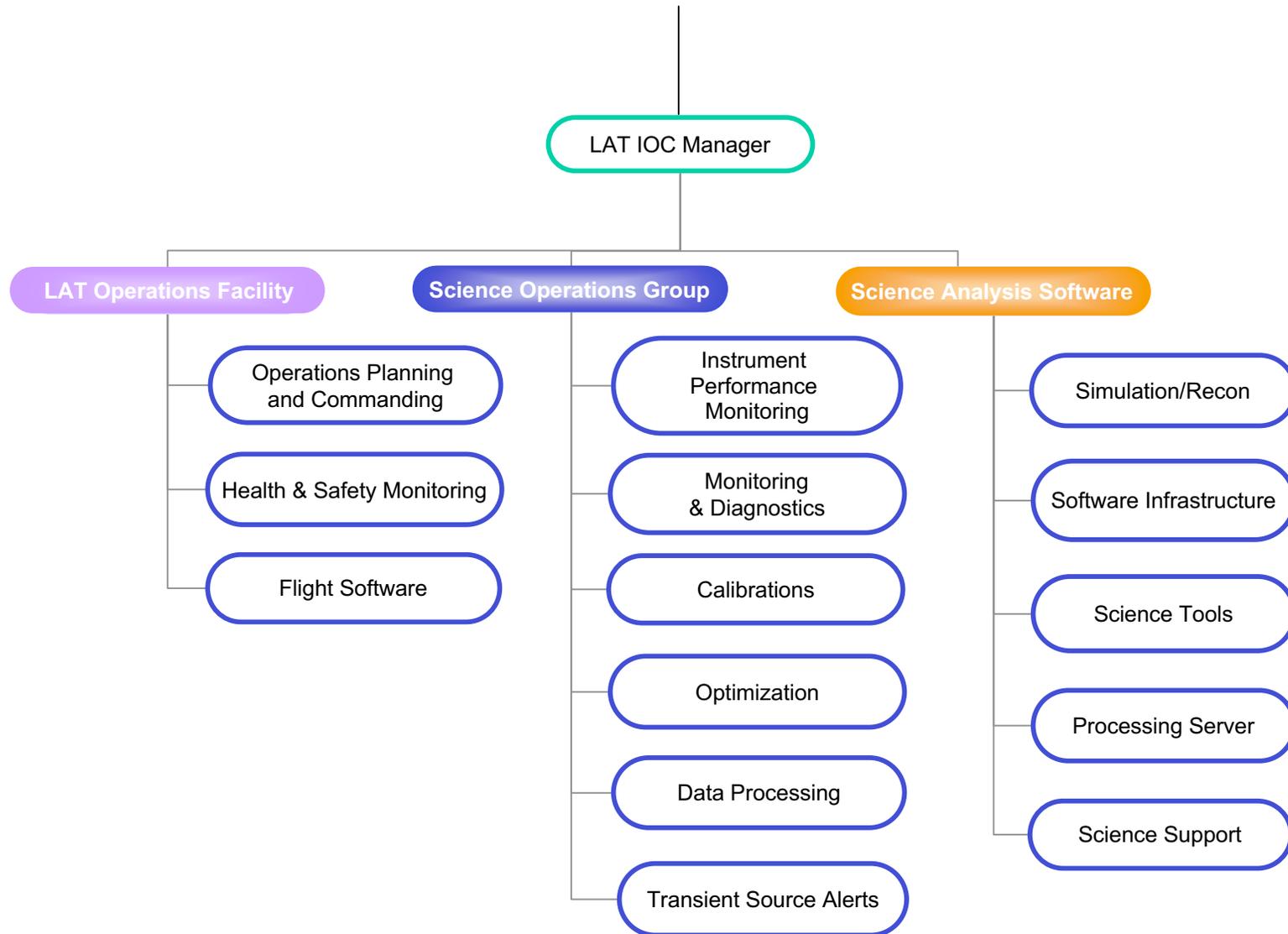


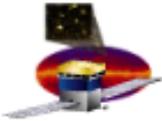
Organization Chart: Operations Phase





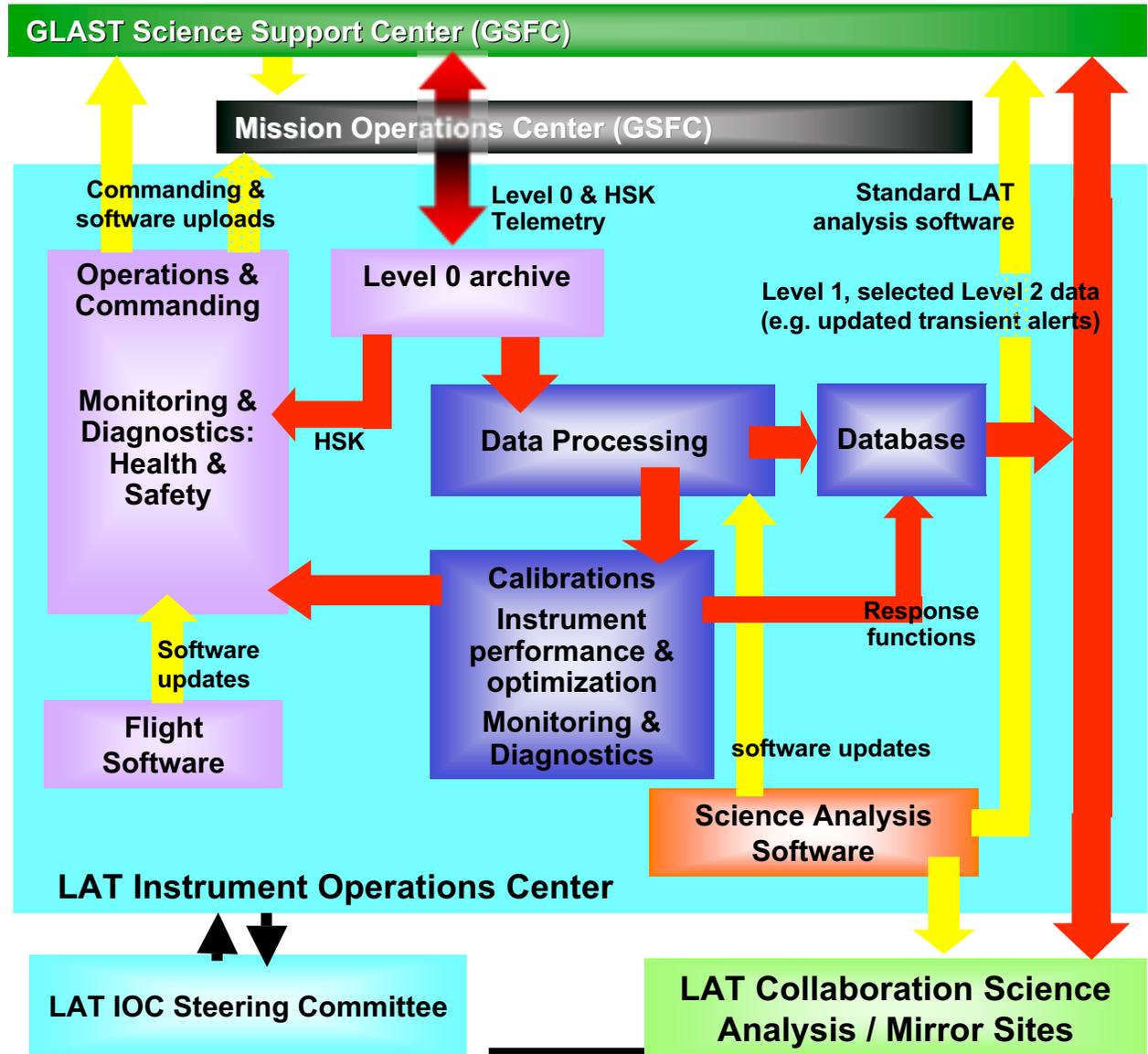
LAT IOC Functional Organization Chart

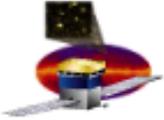




LAT Instrument Operations Center

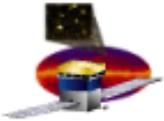
- Receive Level 0 data telemetry packets from MOC
- Perform science data production to generate Level 1 products
- Build and verify commanding plan for LAT instrument
- Support housekeeping monitoring of the instrument for health and safety
- Verify instrument performance and trending
- Archive all Level 0 telemetry packets and Level 1 products
- Develop (with SSC) Standard LAT analysis software
- Support LAT Collaboration science investigation



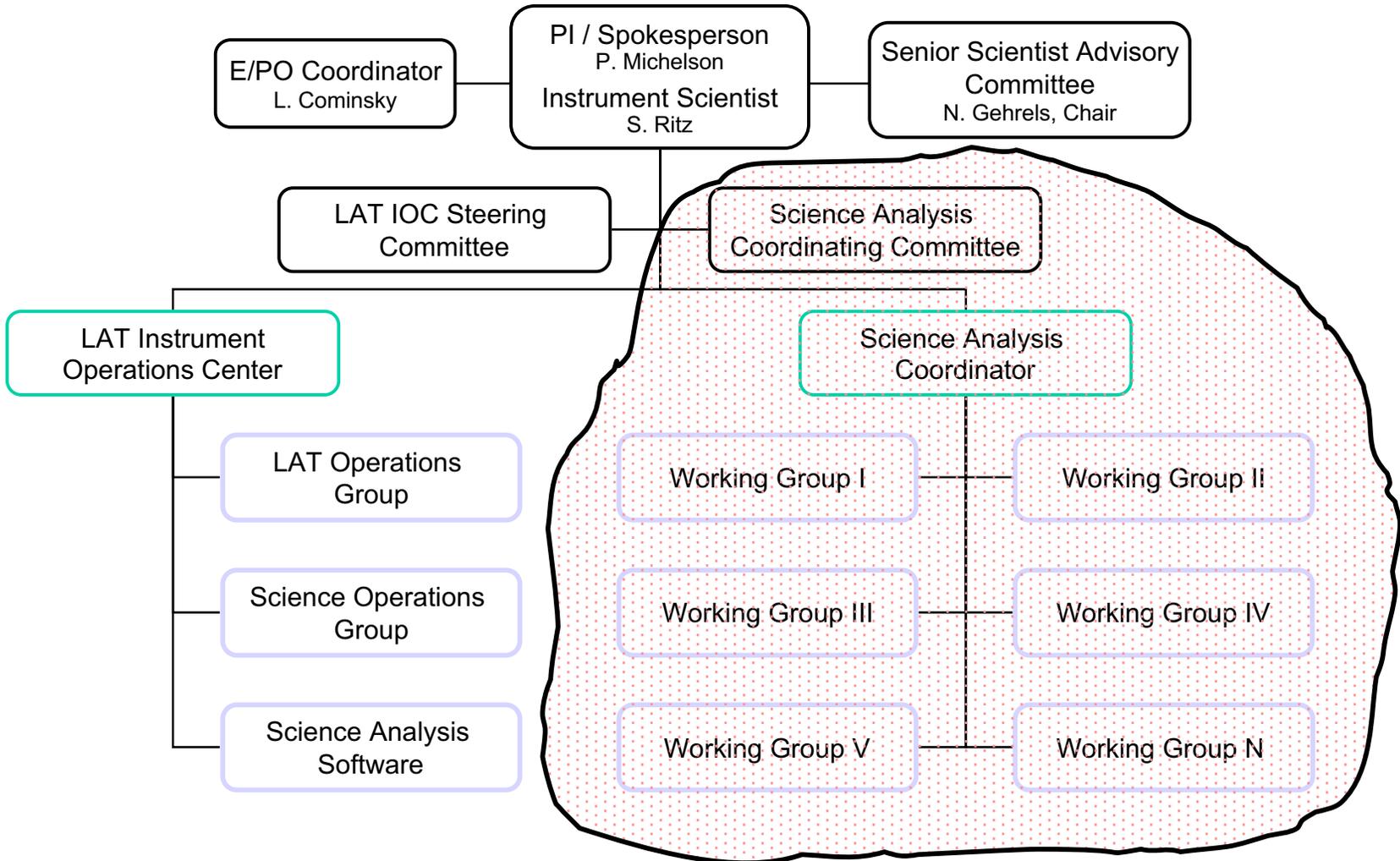


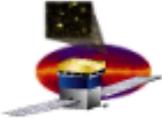
IOC Personnel Needs

IOC	
manager	1
lead engineer	1
LAT Ops. Facility	
manager	1
scientists	3
engineers	3
programmers	1
Science Operations Group	
manager	1
scientists	8
engineers	1
programmers	4
Science Analysis Software	
manager	1
scientists	18
programmers	5
Total	~50



Organization Chart: Operations Phase





Collaboration Science Working Groups

I. Working Group I: Extended Sources and Diffuse Radiation

Galactic Diffuse Radiation and Emission from Normal Galaxies
Gamma-ray Emission from Molecular Clouds
Cosmic Ray Acceleration & Gamma-ray Emission from SNR shells & Plerions
High-Energy Emission from Galaxy Clusters

II. Working Group II: Galactic Sources and Unidentified Sources

Particle Acceleration and Gamma-ray Emission in Pulsars & Binary Systems
Unidentified Sources: Population Studies
Unidentified Sources: Radio/optical/X-ray identifications
High-Energy Emission from Stellar-Mass Galactic Black Hole Candidates
The Galactic Center

III. Working Group III: Extragalactic Sources

Extragalactic Diffuse Radiation and LogN-LogS of Extragalactic Sources
Gamma-ray Emission Mechanisms in Blazar AGNS
Cosmic Evolution of AGN Blazars & Spectral Cutoffs: Population & EBL Studies
High-Energy Emission from Seyfert galaxies & Radio galaxies

IV. Working Group IV: Searches for New Physics

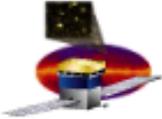
Searches for Dark Matter
Search for Signatures of Quantum Gravity
Search for Primordial Black Hole Evaporation

V. Working Group V: GRBs and Solar Flares

Gamma-Ray Bursts: Testing emission models; afterglows & multiwavelength observations
Solar Flares

Positions of Analysis
Coordinator and
Coordinators of
each Collaboration
Working Group are
collaboration
positions:

These are the current
collaboration working groups;
they will evolve between now
and launch and during
operations phase



LAT Team Projects

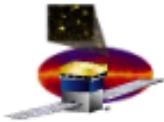
- ▶ data product deliverables identified in flight proposal

All-Sky Survey Project

Data Product	Updates	Comments
Source Catalog	Available and regularly updated on the web, with major publications after 1, 2, and 5 years	Includes significance, flux, spectra, locations, and identifications
All-Sky Map	1, 2, and 5 years	Intensity, counts, and exposure maps over various energy ranges
Residual Maps	1, 2, and 5 years	A residual map for each all-sky map after subtracting point sources and Galactic emission
Diffuse Model	Prelaunch, then update as necessary	

GRB and Transients Project

Data Product	Updates	Comments
GRB Catalog	Monthly via WWW, with periodic refereed publications	Includes fluence, durations, time profiles, spectra, and locations
Transient Alerts	Continuous, on a timescale of days via WWW and IAU circulars for transients. Continuous, on a timescale of seconds for GRBs and via GCN.	GRBs and other transient alerts will include flux and locations. Flaring sources will include possible identifications



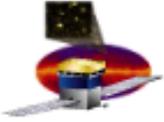
In-depth Analyses of Selected Sources

Table 2.1.6: Selected Sources for In-depth Analyses

Sources	Characteristics	Science Goals
PARTICLE ACCELERATION in PULSARS and PLERIONS		
PSR 1951+32	EGRET pulsar, 39.5 ms, 100 kyr, 2.5 kpc, $B=10^{12}$ G.	Study phase-resolved spectra and test LAT absolute timing data and software; measure the cut-off energy E_{cut} above 10 GeV to extend the $E_{cut}(B)$ relation; spatially resolve its remnant CTB80 ($\varnothing=80'$)
PSR 1617-5055	Radio pulsar not seen by EGRET despite its 8 th rank in E/D^2 , 69 ms, 8 kyr, 6.5 kpc	Deeply search for pulsed emission to constrain the beaming fraction in γ rays vs. polar cap and outer gap predictions; search for DC emission from its remnant RCW103 ($\varnothing=10'$)
PSR1853+01 plerion	267 ms, 20 kyr, 3.3 kpc, $B=2 \cdot 10^{13}$ G, high E/D^2 , in 3EG1856+0114 error box	Study DC emission from the X-ray/radio plerion; search for pulsed emission to extend the $E_{cut}(B)$ relation to high field; spatially resolve the outer shell ($\varnothing44: \varnothing=30'$)
COSMIC-RAY ACCELERATION in SUPERNOVA REMNANTS		
Cas A	SN II in -1670, 2.8 kpc, $\varnothing \sim 5'$	Study young shocks in SN II and SN Ib environments: radio to TeV data to separate electron and nuclei emission; long-term monitoring to look for a compact star; higher density for Cas A & increased LAT sensitivity at $b=6.8'$ for Kepler.
Kepler	SN Ib in 1604, 4.4 kpc, $\varnothing \sim 3'$	
Cygnus Loop	Sedov phase, 360 pc, 230x160	Later SNR stage; spatially and spectrally resolve the nuclei emission; study non-linear acceleration; low Galactic background ($b=8.5'$) for Cyg Loop; enhanced nuclei emissivity expected where IC443 overtakes an H ₂ cloud and X-ray and radio spectra harden
IC443	Sedov phase, 1-2 kpc, $\varnothing \sim 45'$, in 3EG 0617+2236 error box.	
PX0852.0-4822 "Vela, Jr."	880 yr, $\varnothing \sim 2.1'$, closest SNR to Earth, 4.4° away from intense Vela pulsar	Observe using photons from Vela off-pulse time intervals to test source searches and localization in the wings of intense neighbors
NEARBY GALAXIES		
M31	870 kpc, $\varnothing \sim 3'$	Spatially and spectrally resolve their interstellar γ radiation to study cosmic rays, magnetic fields; compare energy balance and mass tracers in different metallicity environments
LMC	55 kpc, $\varnothing \sim 8'$	
SMC	83 kpc, $\varnothing \sim 3'$	
A 1856 Coma cluster	$z=0.02$, $\varnothing \sim 1''$	Constrain the energy density of cosmic rays inside a cluster; resolve the predicted emission above a low background ($b=89''$); study the merging of two clusters
ACTIVE GALACTIC NUCLEI		
PKS0528+134	EGRET flat spectrum quasar, $z=2.08$	Multi-wavelength, multiyear monitoring to explore particle acceleration in blazar jets, in particular γ -ray spectral evolution from quiescent to flaring states
Mrk 501	TeV BL Lac, $z=0.03$	
Cen A	Radio galaxy, $z=0.002$, 3EG1324-4314	
UNIDENTIFIED SOURCE REGIONS		
Rabbit region: $l=313^\circ \pm 1^\circ$, $b=0^\circ \pm 1^\circ$ Ω region: $l=17.5^\circ \pm 1.6^\circ$, $b=-0.75^\circ \pm 0.75^\circ$	3EG1420-6038 and 3EG1410-6147 3EG1826-1302 and 3EG1824-1514	Identify the γ -ray sources in complex regions and test source confusion limits; Rabbit: 2 SNRs, 1 candidate pulsar, 1 candidate plerion, and a few non-thermal shells Ω : 2 SNRs, PSR1823-13 (high E/D^2), and PSR1822-14
Galactic Center	$l=0^\circ \pm 1^\circ$, $b=0^\circ \pm 1^\circ$ 3EG1746-285	Multi-year monitoring of the high-energy activity around SagA* and g -ray source localization with respect to the giant H ₂ clouds and to AXAF, XMM, and INTEGRAL sources
3EG1835+59	Brightest high-latitude, unidentified source, $E^{-1.7}$ spectrum	Search for a radio-quiet pulsar, test periodicity search software
GALACTIC SOURCES WITH RELATIVISTIC JETS		
GRS1915+105	Micro-quasar, 12.5 kpc, jet velocity = 0.9 c	Search for predicted γ -ray emission from relativistic jets at large angles and compare to AGN emission; multi-year monitoring for flaring activity
SS433	5 kpc, jet velocity = 0.3 c	Study termination shocks from jets impacting the remnant shell (120x60') and producing non-thermal X-rays

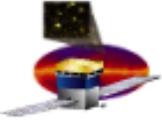
Analysis will:

- use all-sky survey data and multiwavelength campaigns where applicable;
- take advantage of team's expertise, particularly in modelling the structured Galactic background to resolve extended sources



Needs during Operations Phase (presented to IFC, September 5, 2003)

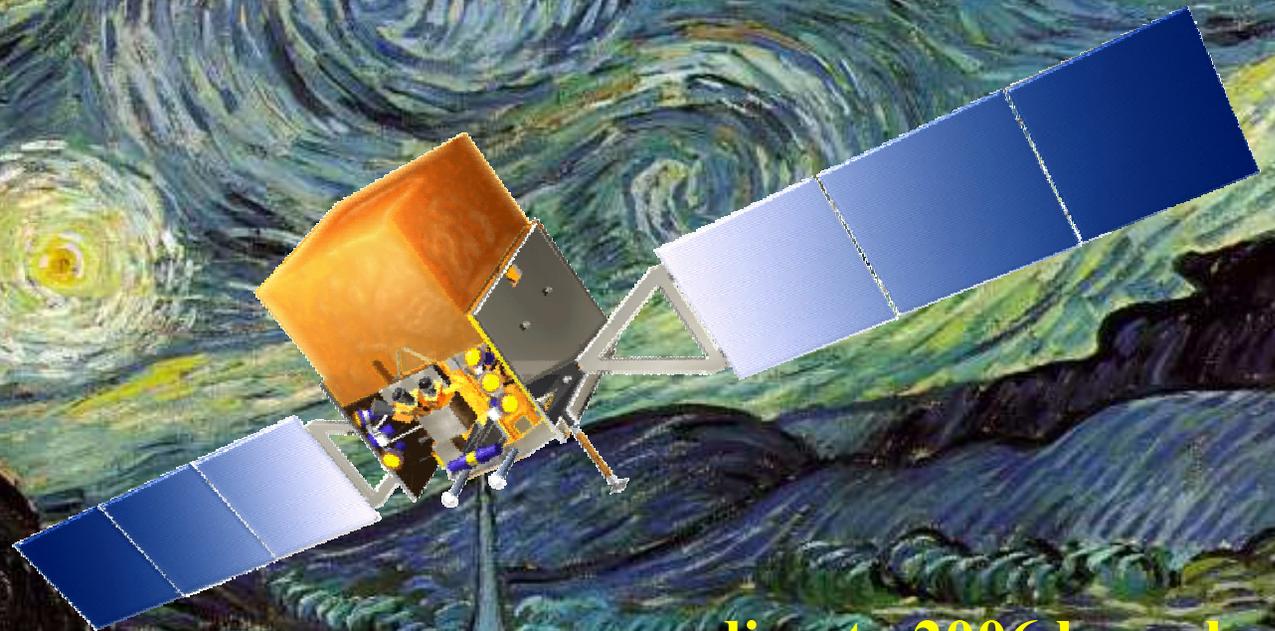
- Support for Collaboration members in residence/visiting SU - SLAC
 - anticipate ~20 FTE scientists from Collaboration, on average, in steady-state; transient number will be larger (2x) for 1-2 weeks at a time, a few times per year
 - need office space
 - will also require travel and per diem support from home institutions
- Collaboration Meetings ~3-4 per year: will rotate location/host among collaborating institutions – these meetings will ramp-up to this frequency during Commissioning Phase
- Operating Phase Common Fund discussed
 - Potentially support downlink costs
 - Publications
 - Collaboration meeting costs



next steps

- identify Instrument Operations Center Manager:
 - position currently posted
 - will form search committee to identify “shortlist” of candidates
 - plan to fill position by end of calendar year
- Assess availability of collaboration personnel to participate in I&T at SLAC and instrument operations

GLAST: Exploring Nature's Highest Energy Processes



proceeding to 2006 launch